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Telonic
ENGINEERING CO.
A DIVISION OF TELONIC INDUSTRIES, INC.

Telonic®

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A DIVISION OF TELONIC INDUSTRIES, INC.

Presenting a comprehensive line of microwave and RF components covering the 1 Mc to 6Gc frequency range. This catalog includes complete specifications on Telonic's Low-Pass, Band-Pass, Tunable Band-Pass, Cavity, and Interdigital Filters, Varactor Multipliers, VSWR-Measuring Devices, Matched and Mismatched Coaxial Terminations and Special Microwave Devices.

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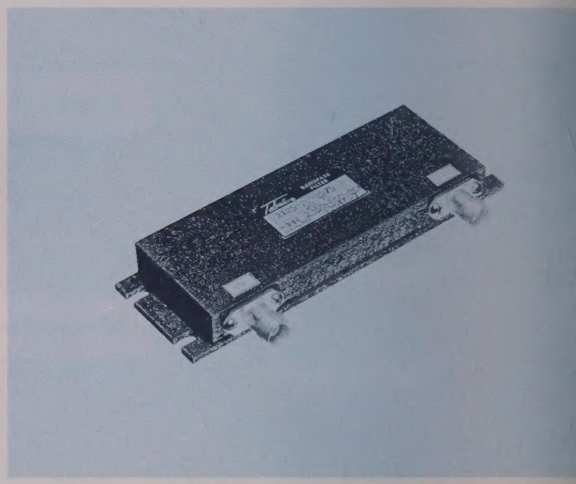
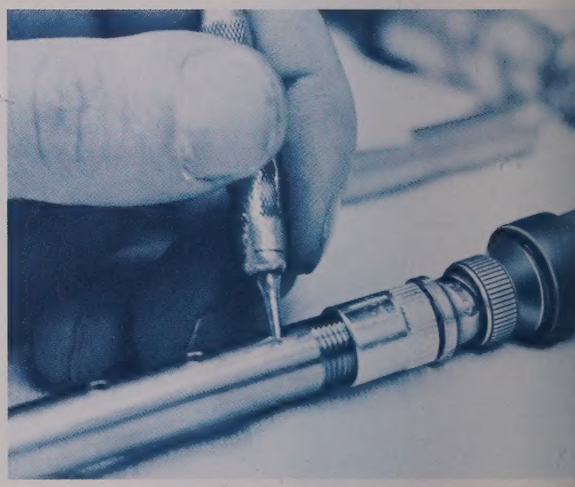
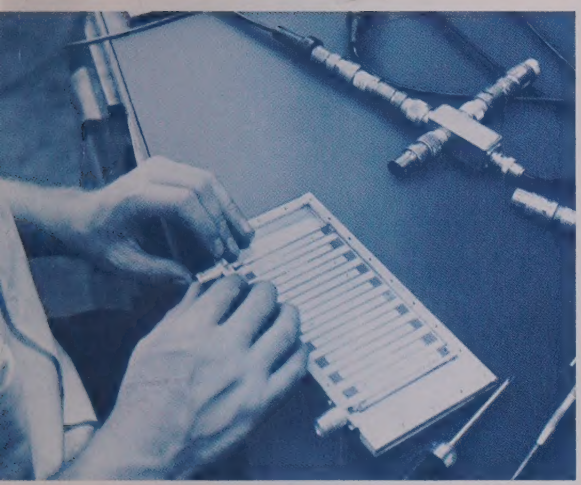


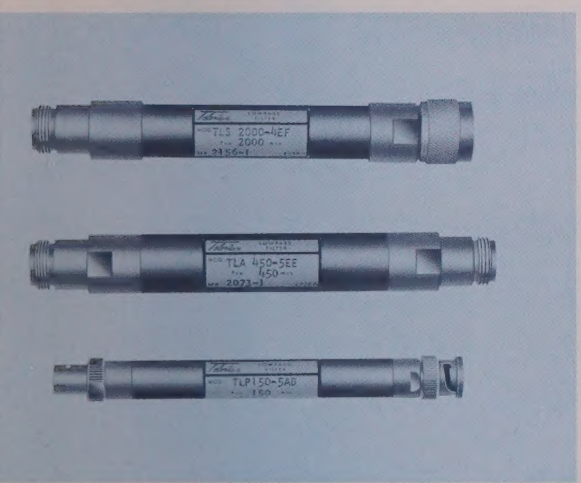


Telonic Engineering Co. with its many years of experience in the development, design and manufacture of precision R.F. and Microwave devices, and through its close association with Telonic Industries, Inc. offers a unique capability as a dependable and comprehensive source of quickly available, high quality microwave products.

All Telonic Engineering products are manufactured in accordance with manufacturing and quality control procedures which have been approved by the Government and its prime contractors. These products are manufactured from 100% certified materials and are designed to withstand environments covered by current military equipment specifications.

In addition to the comprehensive filter line, Telonic offers the electronic engineer a variety of other microwave devices. The Rho-Tector for determining VSWR values, standard matched and mismatched





terminations, frequency multipliers, power dividers, and multiplexers are but a few of the many products available.

Telonic's facility in Laguna Beach, California, includes the latest in swept frequency instrumentation, power and impedance measuring equipment, as well as an extensive array of mechanical measuring and manufacturing equipment. Telonic is the originator of the specify-your-own-filter part numbering system which allows the customer to quickly generate a model number from his own design parameters.

For example, in the case of a bandpass filter, the model number alone defines the filter type, center frequency, bandwidth, number of sections, and input and output connectors. This system supplemented by a modular design concept and a large inventory of parts creates a unique capability allowing extremely quick delivery on special items as well as on the standard line of products. (SEE 72 HOUR JET ORDER SERVICE on TLP, TLA, TBP, TBA Series.)

POLICY

WARRANTY
Products manufactured by Telonic Engineering Co. are guaranteed for a period of ONE YEAR from date of purchase against defective materials and workmanship. Telonic Engineering Co. expressly limits its liability to replacement or repair of the article furnished. This warranty does not apply to products that have been dis-assembled, modified or subjected to conditions exceeding the applicable specifications and ratings. In the event of any of the foregoing, the guarantee will be voided.

TECHNICAL ASSISTANCE
Call or write the factory or our representative for assistance in meeting your requirements if they should differ from the data presented in this catalog.

ORDERING
Items should be ordered by part number and name. Code numbering procedures are outlined in the following pages where too large a number of models prohibits listing. Any special requirements should clearly be stated when ordering.

TERMS
Terms of payment are 1% discount if remitted within 10 days from invoice date or net in 30 days. All prices are F.O.B. Laguna Beach, California. Shipment will be made on an open account basis to customers with approved credit.

REPRESENTATIVE
Telonic Engineering Co. is represented throughout the U.S.A., Canada, Great Britain, Europe, the Near East and the Orient by qualified, select sales representatives. They are available to supply you with technical data, literature, application engineering and assistance in selecting and specifying Telonic filters and other components.

SERVICING & RETURN OF PRODUCTS FOR REPAIR
To return items for repair, please contact the Sales Department at the factory for permission to return. All returned goods are to be shipped prepaid and must be identified by P.O. number, part number, and nature of malfunction.

Low-Pass Filters

Section 2

Telonic

LOW-PASS FILTERS

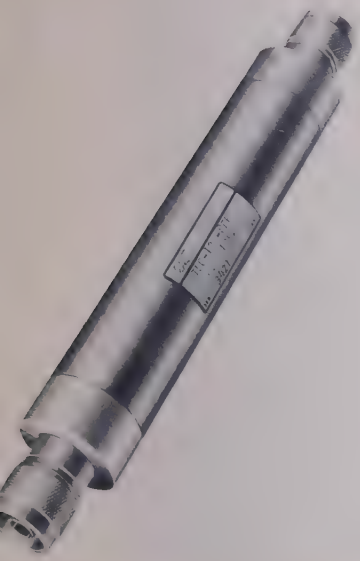
- *30 Mc TO 3 Gc FREQUENCY RANGE*
- *HIGH STOP-BAND REJECTION*
- *LOW VSWR* • *LOW PASS-BAND ATTENUATION*
- *MINIMUM SIZE* • *RUGGED CONSTRUCTION*

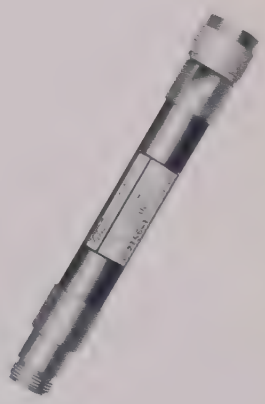
TYPE	TLP	TLA
CUT-OFF FREQUENCY RANGE	100-2500 Mc	50-1500 Mc
TYPICAL PASS-BAND INSERTION LOSS	0.2DB/SECT.	0.1DB/SECT.
RATED POWER INPUT	30 WATTS	100 WATTS
PASS-BAND VSWR (DC-Fc)	1.5/1 MAX.	
TYPICAL FREQUENCY RESPONSE	SEE FIGURE 1, PAGE 8	
DESIGN TYPE	LUMPED CONSTANT (HELICAL RESONATORS AND COAXIAL CAPACITORS)	
NOMINAL IMPEDANCE	50 OHMS	
TEMPERATURE RANGE	−55°C TO +125°C	
MATERIAL	18% Ni SILVER	ALUMINUM
DIAMETER	.50 IN.	.75 IN.
LENGTH*	3½ IN.	4⅞ IN.
WEIGHT*	2.3 OZ.	3 OZ.

*Lengths and weights shown are typical for 1000 Mc-cutoff, 4-section filters with TNC connectors.

Series TLP, TLA, TLC, TLR, TLS

Telonic Low-Pass Filters are of 0.1-db Chebyshev design. Standard configurations are of 1 to 8 sections (3 to 17 poles) depending on filtering characteristics desired. All models exhibit high stop-band rejection, and minimum attenuation in the pass band. Precise control of performance characteristics assures low VSWR over the entire passband.
Ruggedly constructed, these filters are designed to withstand severe environmental stresses including temperature cycling, shock, vibration, and acceleration. Each individual filter is given a complete electrical and performance test prior to shipping and a test report is packaged with the filter. A number of standard connector types may be specified, and a variety of special connector configurations, cable inputs, outputs, and terminal types are available on special order.





TLC	TLR	TLS
30-1000 Mc	200-3000 Mc	200-3000 Mc
0.05DB/SECT.	0.1DB/SECT.	0.05DB/SECT.
300 WATTS	30 WATTS	100 WATTS
	1.5/1 MAX.	
	SEE FIGURE 1, PAGE 8	
	RESONANT LINE (ALT. LENGTHS OF HIGH AND LOW IMPEDANCE COAXIAL LINE)	
	50 OHMS	
	−55°C TO +150°C	
ALUMINUM	18% Ni SILVER	ALUMINUM
1.25 IN.	.44 IN.	.69 IN.
5⅛ IN.	7¼ IN.	6¾ IN.
6 OZ.	2.8 OZ.	2.8 OZ.

TYPICAL RESPONSE CURVES

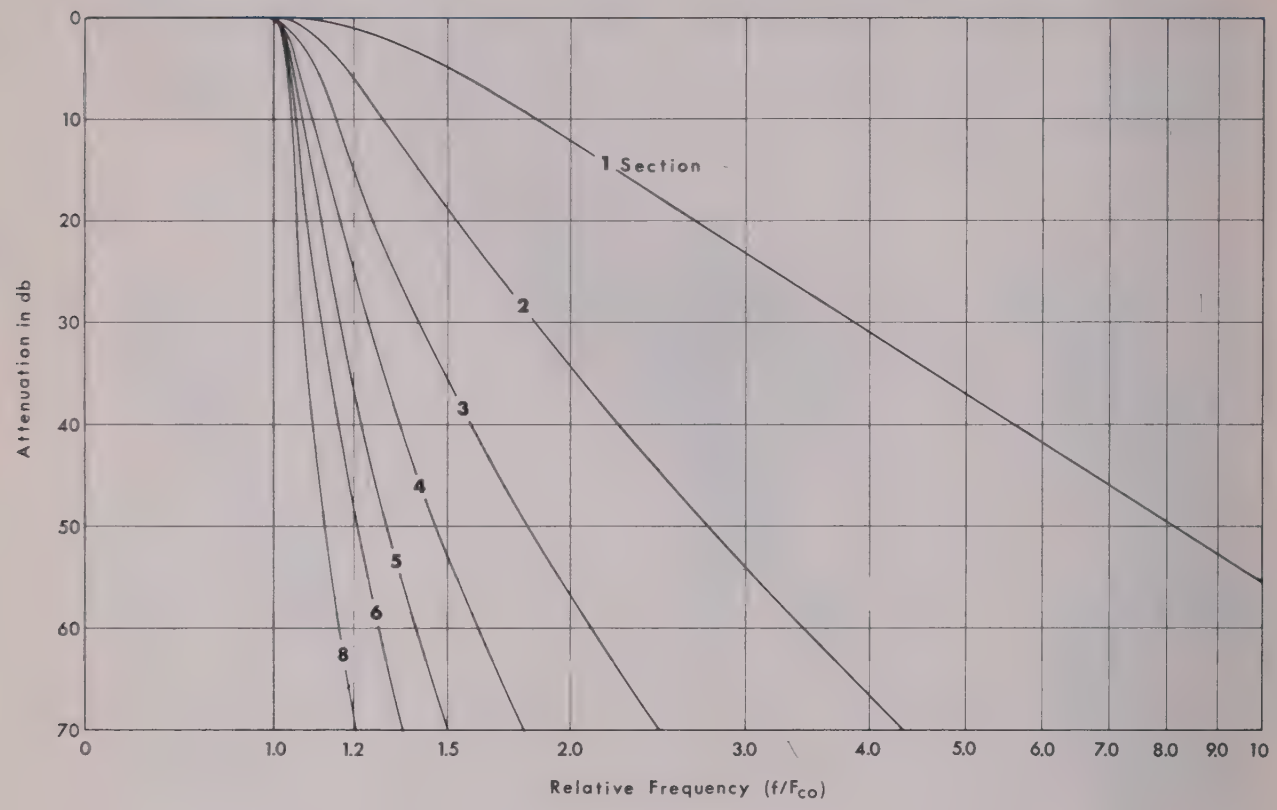
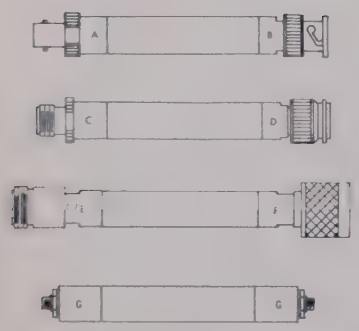


Figure 1



ORDERING INFORMATION

TLA 290–4 A B

- Output Connector
- Input Connector
- Number of Sections
- Series
- Cut-off Frequency in Mc

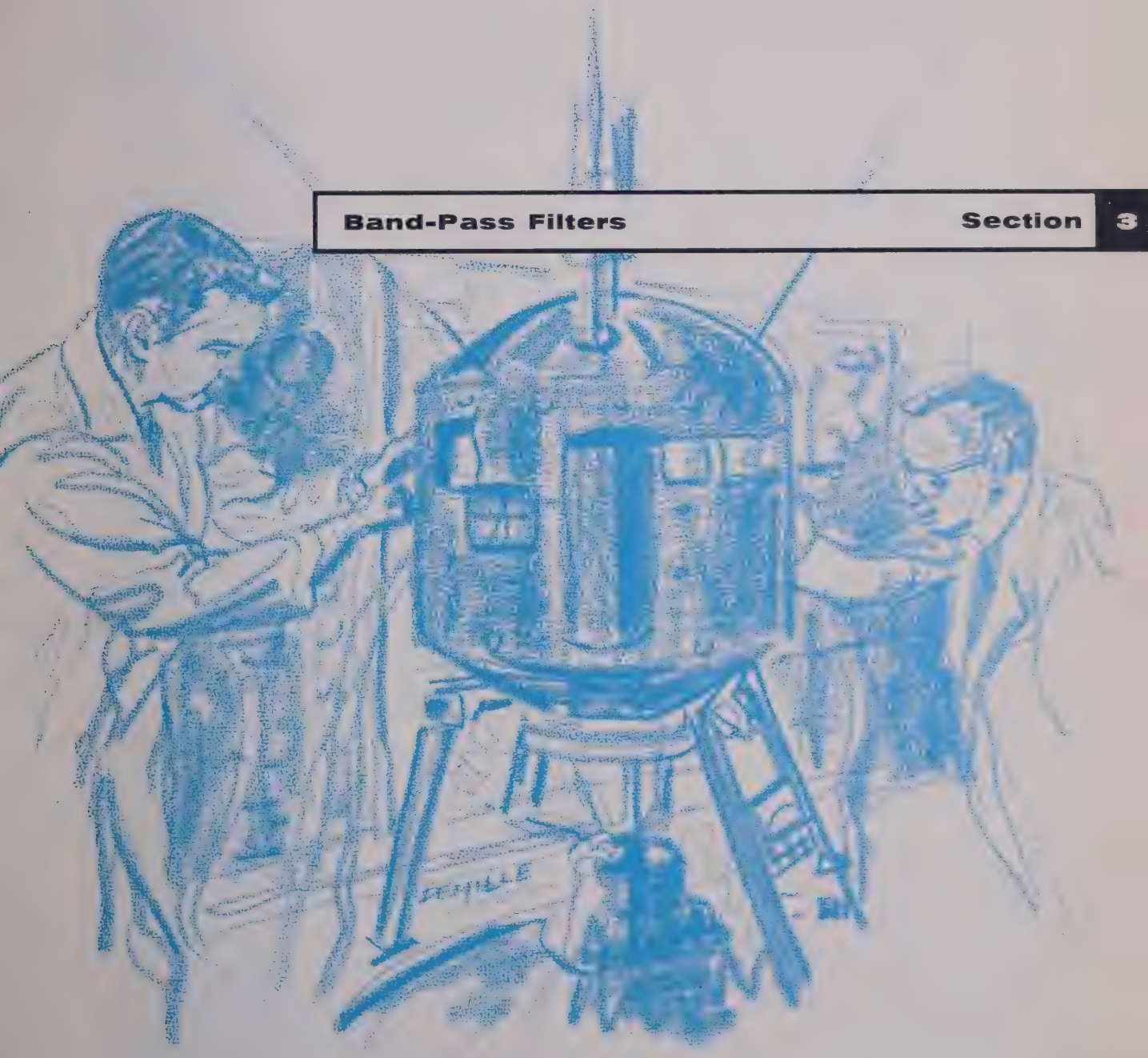
CONNECTOR CODE:

A — BNC Jack*	E — N Jack
B — BNC Plug*	F — N Plug
C — TNC Jack	G — Microdot Jack
D — TNC Plug	X — Special

CONNECTOR TYPES *BNC Connectors are not standard above 1000mc

Band-Pass Filters

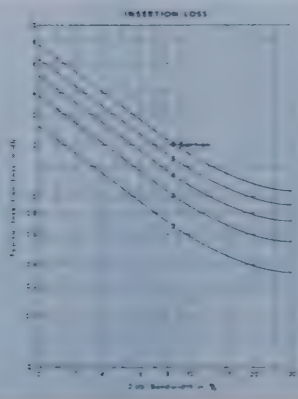
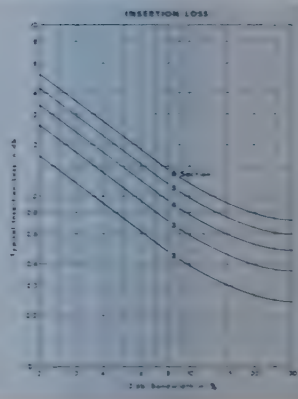
Section 3



Telonic

BAND-PASS FILTERS

- 30 Mc TO 2.5 Gc FREQUENCY RANGE
- BANDWIDTH 2 TO 30%
- COAXIAL CONFIGURATION
- LOW VSWR
- SMALL SIZE
- RUGGED CONSTRUCTION

TYPE	TBP	TBA
CENTER-FREQUENCY RANGE	100-2500 Mc	50-2000 Mc
3-DB-BANDWIDTH RANGE		2 TO 30%
TYPICAL FREQUENCY RESPONSE		SEE FIGURE 2
VSWR		1.5/1 MAX.
VSWR BANDWIDTH		SEE FIGURE 3
RATED POWER INPUT	10 WATTS	30 WATTS
NOMINAL IMPEDANCE		50 OHMS
STOP-BAND REJECTION (MIN.)		20 DB/SECTION TO 10 Gc
TEMPERATURE RANGE		−55°C TO +125°C
MATERIAL	18% Ni SILVER	ALUMINUM
DIAMETER	0.5 IN.	0.75 IN.
LENGTH*	5¼ IN.	6¾ IN.
WEIGHT*	3.2 OZ.	3.2 OZ.
TYPICAL INSERTION LOSS		

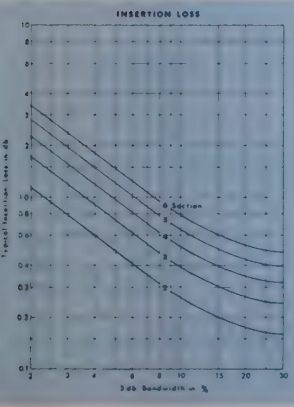
*Lengths and weights shown are typical for 200 Mc-center frequency, 20 Mc bandwidth, 4-section filters with TNC connectors.

(Tubular) Series TBP, TBA, TBC

Telonic Tubular Band-Pass Filters are the most widely used of their type in the world today. They are Chebychev (equal ripple) design and available with 2 to 6 sections depending on the characteristics required. All three series exhibit low insertion loss and low VSWR as shown in the charts below.

These filters are constructed to operate in extreme environmental conditions, are highly dependable, and compact for maximum density packaging. Each unit is given a 100% check-out prior to shipment and comes complete with a test report. Modular-type construction permits quick availability for special requirements as well as the standard filter line. Various connectors available are shown under "Order Information." Special connectors may also be specified. Contact the factory for information.

TBC
30-1500 Mc
100 WATTS
ALUMINUM
1.25 IN.
7⅜ IN.
7.7 OZ.



FREQUENCY RESPONSE

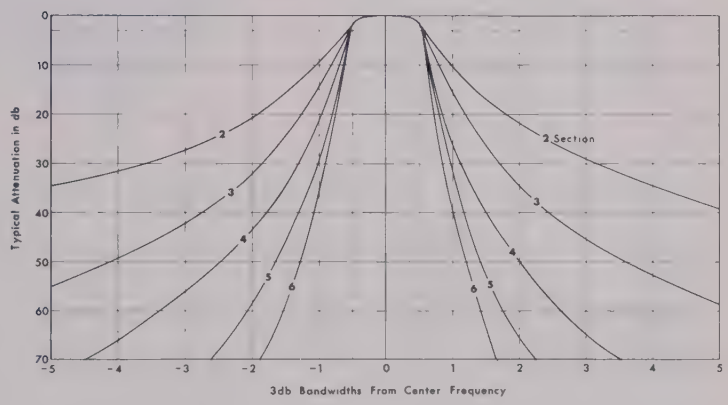


Figure 2

VSWR BANDWIDTH					
NO. OF SECTIONS	2	3	4	5	6
VSWR Bandwidth / 3 db Bandwidth	0.50	0.70	0.80	0.85	0.90

Figure 3

ORDERING INFORMATION

TBP 450 – 25 – 5 A B

- Series
- Center Frequency (Mc)
- 3 db Bandwidth (Mc)
- Number of Sections
- Input Connector
- Output Connector

CONNECTOR CODE

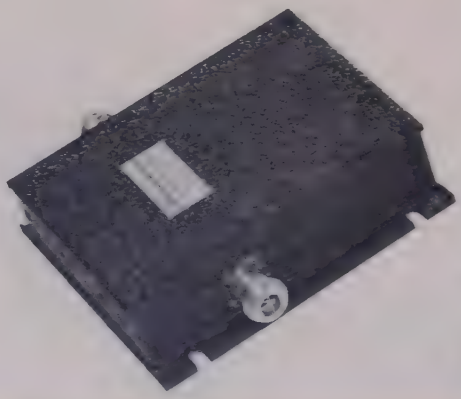
A — BNC Jack*
B — BNC Plug*
C — TNC Jack
D — TNC Plug
E — N Jack
F — N Plug
G — Microdot Jack
X — Special

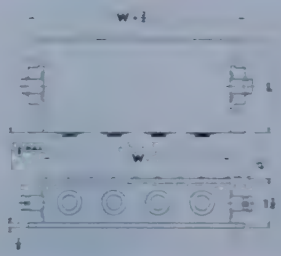
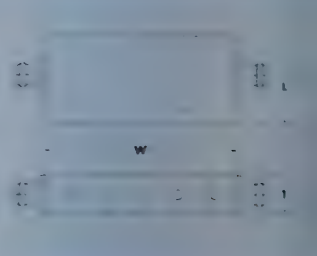
*BNC Connectors are not standard above 1000 Mc.

Telonic

BAND-PASS FILTERS

- LIGHT WEIGHT, RUGGED CONSTRUCTION
- LOW PASS-BAND VSWR
- HIGH SELECTIVITY
- LOW INSERTION LOSS
- 30 Mc TO 6 Gc Ranges



TYPE	TCF	TCA
DESIGN	IRIS-COUPLED COAXIAL CAVITY	
CENTER-FREQUENCY RANGE	400-4000 Mc	1000-6000 Mc
3-DB BANDWIDTH RANGE		0.3 - 3%
NUMBER OF SECTIONS		2 - 6
VSWR	1.5/1 MAX.	
VSWR BANDWIDTH		FIGURE 4
TYPICAL LOSS CONSTANT*	0.3	0.2
TYPICAL 30DB FORM FACTOR**		FIGURE 4
NOMINAL IMPEDANCE	50 OHMS	
CONSTRUCTION	SLOTTED BOX	BORED BLOCK
DIMENSION L (IN.)	FIGURE 6	$0.75 + \frac{2.5}{\text{CENTER FREQUENCY IN Gc (APPROX.)}}$
DIMENSION W (IN.)	$\frac{1}{4} + 1\frac{1}{8}$ X (NO. OF SECTIONS)	$\frac{3}{16} + \frac{15}{16}$ X (NO. OF SECTIONS)
OUTLINE DRAWING		

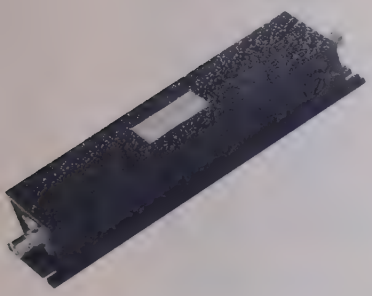
*Insertion loss, db = $\frac{\text{(Loss constant) X (No. of sections)}}{\text{3-db Bandwidth (\%)}}$

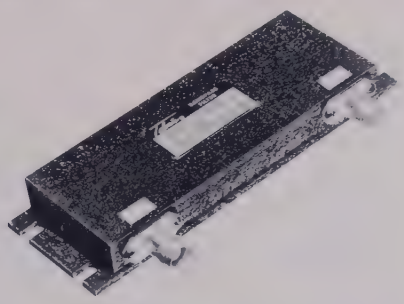
***30-db Form Factor = $\frac{\text{30-db Bandwidth}}{\text{3-db Bandwidth}}$

Series TCF, TCA, TSF, TIF

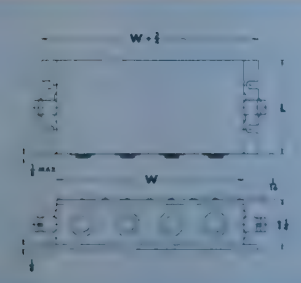
These Telonic Band-Pass Filters are designed to provide the best combination of electrical performance and mechanical construction. The engineer has a wide range of types and specifications to select from with center frequencies varying from 30 Mc to 6000 Mc and bandwidths from 0.3% to 30%.

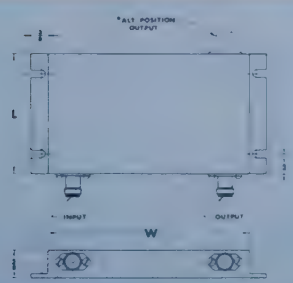
All types exhibit low insertion loss, low VSWR and low ripple in the passband. The filters are constructed of bored out aluminum block or slotted aluminum plate to provide maximum strength, minimum weight, and lowest signal losses.





TSF	TIF
IS-COUPLED HELICAL CAVITY	INTERDIGITAL
30-400 Mc	1000-6000 Mc
	3 - 30%
	6 - 19
1.5/1 MAX.	
	0.9 X (3-DB BANDWIDTH)
1.0	1.0
	FIGURE 5
50 OHMS	
SLOTTED BOX	STRIP-LINE
Fc = 30-99Mc: 2⅛ Fc = 100-400Mc: 1⅛	$0.625 + \frac{3}{\text{CENTER FREQ. IN Gc (APPROX.)}}$
¼ + 1⅛ X (NO. OF SECTIONS)	2¼ + ⅞ X (NO. OF SECTIONS)APPROX.





SECTIONS	30-DB FORM FACTOR	VSWR BW 3DB BW
2	5.5	0.50
3	3.0	0.70
4	2.4	0.80
5	2.0	0.85
6	1.7	0.90

Figure 4

SECTIONS	30-DB FORM FACTOR
6	1.50
7	1.40
8	1.30
9	1.25
11	1.15
13	1.10
15	1.08
19	1.05

Figure 5

CENTER FREQUENCY	L (IN.)
400 - 600 Mc	4⅛
600 - 800 Mc	3⅛
800 - 1200 Mc	2⅛
1200 - 1600 Mc	2⅛
1600 - 2400 Mc	1⅞
2400 - 4000 Mc	1⅜

Figure 6

ORDERING INFORMATION

TCA 1710-8-5 E F

- TCA — Series
- 1710 — Center Freq. (Mc)
- 8 — 3-db Bandwidth (Mc)
- 5 — Number of Sections
- E — Input Connector
- F — Output Connector

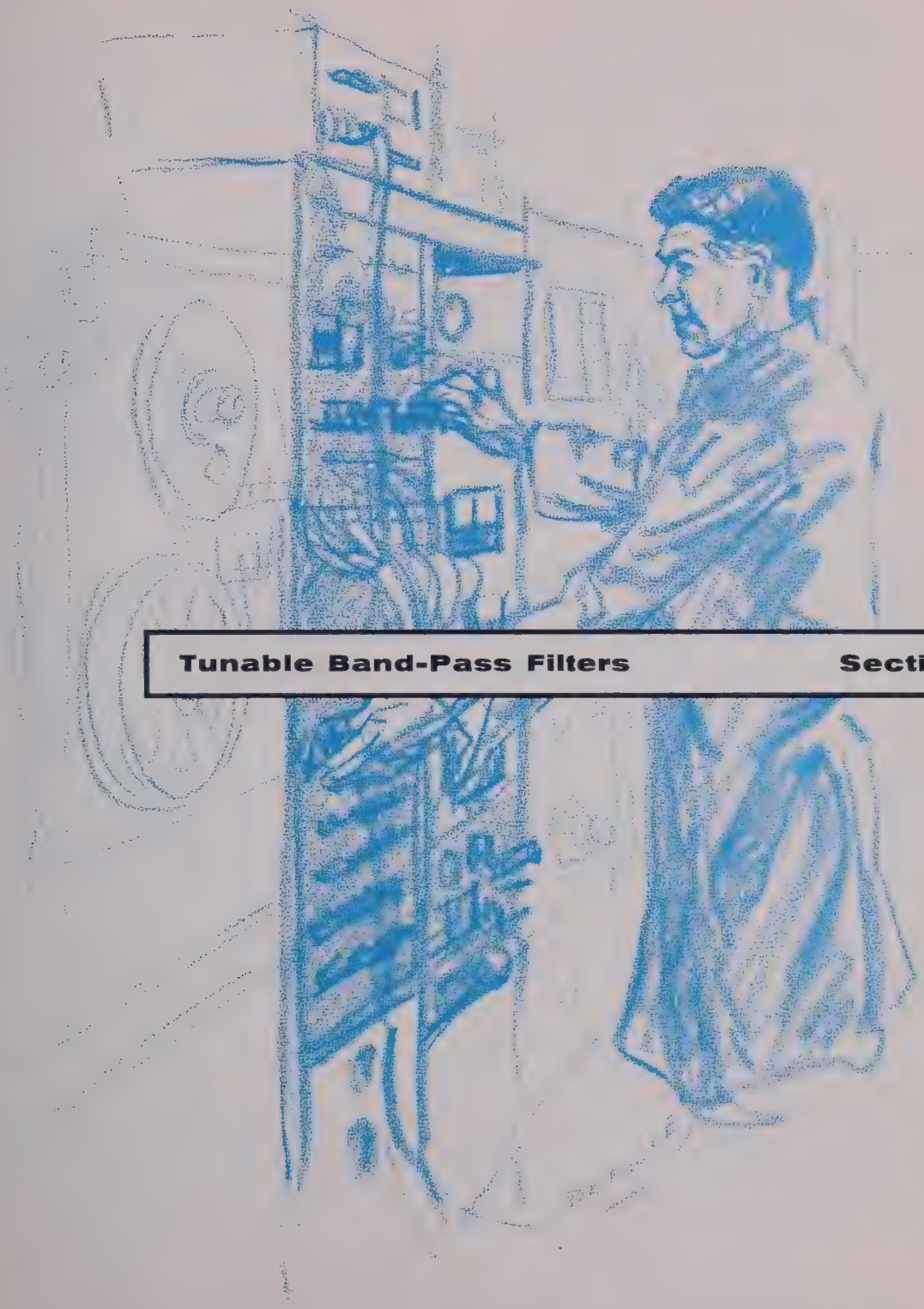
CONNECTOR CODE

A — BNC Jack*	F — N Plug
B — BNC Plug*	H — TM Jack
C — TNC Jack	Q — TM Plug
D — TNC Plug	J — TPS Jack
E — N Jack	K — TPS Plug

*BNC Connectors are not standard above 1000 Mc.

SPECIAL FILTERS

Telonic is able to supply both low-pass and band-pass filters in special configurations to meet your exact design requirements. These custom versions may include special electrical characteristics, special connectors, connector leads, brackets or other "non-standard" accessory items. The basic filters themselves are constructed of standard Telonic "modular" parts greatly simplifying production, expediting deliveries of your order, and assuring you of the same high performance and dependability as in all Telonic filters.



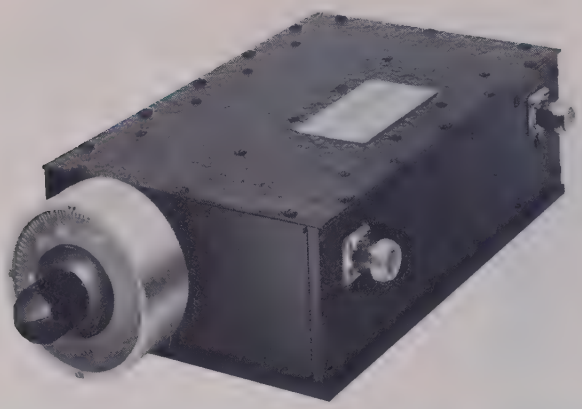
Tunable Band-Pass Filters

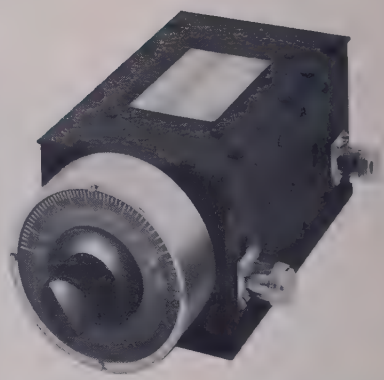
Section 4

Telonic

TUNABLE BAND-PASS

- *50 Mc TO 3 Gc RANGE*
- *VERNIER CONTROL*
- *FREQUENCY-READING DIALS*
- *LOW VSWR IN PASSBAND*
- *INDIVIDUALLY CALIBRATED*
- *SINGLE-KNOB TUNING*
- *SPECIAL SERIES FOR TELEMETRY*



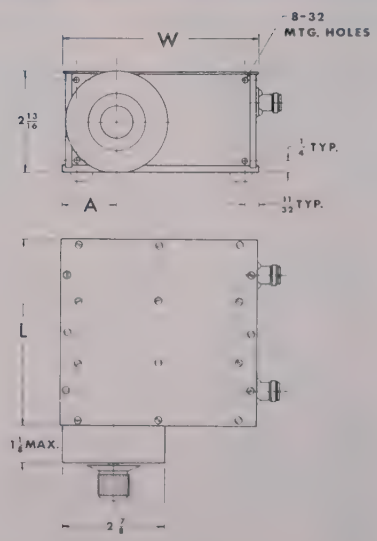


TYPE	5% SERIES	TELEMETRY SERIES
VSWR	1.5/1 MAXIMUM	1.5/1 MAXIMUM
IMPEDANCE	50 OHMS	50 OHMS
INSERTION LOSS	SEE FIGURE 7	SEE FIGURE 8, PAGE 18
DIAL ACCURACY	± 1% OF CENTER FREQUENCY	SEE FIGURE 8, PAGE 18
3DB BANDWIDTH	5% ± 1%	SEE FIGURE 8, PAGE 18
STANDARD CONNECTORS*	TYPE N, FEMALE	TYPE N, FEMALE

*BNC, TNC and other connectors, various frequency ranges and bandwidths from 1 to 10% are available on special request. Please consult the factory for information.

OUTLINE DIMENSIONS

Refer to Figures 7 and 8



ORDERING INFORMATION

See Figures 7, 8

FILTERS - Series TTF

Telonic TTF Tunable Band-Pass Filters are available in 3 and 5 section configurations permitting wide selection of filtering characteristics. Each section is capacity loaded to tune over a 2 to 1 range and has an inherent high Q to maintain low insertion losses. A 5%-Bandwidth Series and a special Telemetry Series are available in both the 3- and 5-section models.

These filters are packaged in a slotted aluminum case for maximum mechanical stability and low RF leakage. All models can easily be panel mounted by the user without additional hardware.

The vernier tuning dial is directly calibrated in frequency prior to shipment, allowing application without further adjustment and without the use of charts.

TTF FILTERS 5% Series

MODEL NO.	TUNING RANGE (Mc)	SECTIONS	INSERTION LOSS (db) TYP.	INSERTION LOSS (db) MAX.	30db FORM FACTOR TYP.	30db FORM FACTOR MAX.	50db FORM FACTOR TYP.	50db FORM FACTOR MAX.	DIMENSIONS (in.) L	W	A
TTF 72-5-3EE	48-95	3	0.5	1.0	3.5	4.5	—	—	5¼	5½	1½
TTF 72-5-5EE	48-95	5	1.0	1.5	2.0	2.5	3.0	4.0	8½	5½	1½
TTF 95-5-3EE	63-125	3	0.5	1.0	3.5	4.5	—	—	5¼	5½	1½
TTF 95-5-5EE	63-125	5	1.0	1.5	2.0	2.5	3.0	4.0	8½	5½	1½
TTF 125-5-3EE	95-190	3	0.5	1.0	3.5	4.5	—	—	5¼	5½	1½
TTF 125-5-5EE	95-190	5	1.0	1.5	2.0	2.5	3.0	4.0	8½	5½	1½
TTF 190-5-3EE	125-250	3	0.5	1.0	3.0	4.0	—	—	5¼	5½	1½
TTF 190-5-5EE	125-250	5	1.0	1.5	1.8	2.5	2.5	3.5	8½	5½	1½
TTF 250-5-3EE	190-375	3	0.5	1.0	3.0	3.5	—	—	5¼	5½	1½
TTF 250-5-5EE	190-375	5	1.0	1.5	1.8	2.5	2.5	3.5	8½	5½	1½
TTF 375-5-3EE	250-500	3	0.5	1.0	3.0	3.5	—	—	5¼	5½	1½
TTF 375-5-5EE	250-500	5	0.8	1.0	1.7	2.2	2.5	3.5	8½	5½	1½
TTF 500-5-3EE	375-750	3	0.5	1.0	3.0	3.5	—	—	5¼	5½	2⅝₂
TTF 500-5-5EE	375-750	5	0.6	1.0	1.7	2.2	2.5	3.5	8½	5½	2⅝₂
TTF 750-5-3EE	500-1000	3	0.5	1.0	3.0	3.5	—	—	5¼	5½	2¼
TTF 750-5-5EE	500-1000	5	0.6	1.0	1.7	2.2	2.5	3.5	8½	5½	2¼
TTF 1000-5-3EE	750-1500	3	0.4	0.8	3.0	3.5	—	—	5¼	5½	3¹⁵⁄₃₂
TTF 1000-5-5EE	750-1500	5	0.6	1.0	1.7	2.2	2.5	3.5	8½	5½	3¹⁵⁄₃₂
TTF 1500-5-3EE	1000-2000	3	0.4	0.8	3.0	3.5	—	—	3¾	3⅛	1⅞₆
TTF 1500-5-5EE	1000-2000	5	0.6	1.0	1.7	2.2	2.5	3.5	6	3⅛	1⅞₆
TTF 2250-5-3EE	1500-3000	3	0.4	0.8	3.0	3.5	—	—	3¾	3⅛	1¹¹⁄₁₆
TTF 2250-5-5EE	1500-3000	5	0.6	1.0	1.5	2.0	2.5	3.5	6	3⅛	1¹¹⁄₁₆

Figure 7

TTF FILTERS Telemetry Series

MODEL NO.	TUNING RANGE (Mc)	SECT.	DIAL ACC.	3 db BW	INS. LOSS db TYP.	INS. LOSS db MAX.	30 db FF TYP.	30 db FF MAX.	50 db FF TYP.	50 db FF MAX.	DIMENSIONS L	DIMENSIONS W	DIMENSIONS A
TTF-237-1-3EE	210-265	3	0.5%	1±0.2%	1.5	2.0	3.0	3.5	—	—	5¼	5½	1½
TTF 237-1-5EE	210-265	5	0.5%	1±0.2%	2.0	3.0	2.0	2.5	2.5	3.5	8½	5½	1½
TTF 1485-0.5-3EE	1425-1545	3	0.2%	0.5±0.1%	1.5	2.0	3.0	3.5	—	—	5¼	5½	2¼
TTF 1485-0.5-5EE	1425-1545	5	0.2%	0.5±0.1%	2.0	3.0	2.0	2.5	2.5	3.5	8½	5½	2¼
TTF 1780-0.5-3EE	1700-1860	3	0.2%	0.5±0.1%	1.5	2.0	3.0	3.5	—	—	5¼	5½	2½
TTF-1780-0.5-5EE	1700-1860	5	0.2%	0.5±0.1%	2.0	3.0	2.0	2.5	2.5	3.5	8½	5½	2½
TTF 2250-0.5-3EE	2190-2310	3	0.2%	0.5±0.1%	1.5	2.0	3.0	3.5	—	—	3¾	3⅛	1⅞
TTF 2250-0.5-5EE	2190-2310	3	0.2%	0.5±0.1%	2.0	3.0	2.0	2.5	2.5	3.5	6	3⅛	1⅞

Figure 8

VSWR Instrumentation

Section 5

Telonic RHO-TECTOR VSWR DETECTOR

- *VERY HIGH ACCURACY*
- *2500:1 BANDWIDTH*
- *WIDE IMPEDANCE RANGE*
- *HIGH SENSITIVITY*
- *SMALL SIZE*

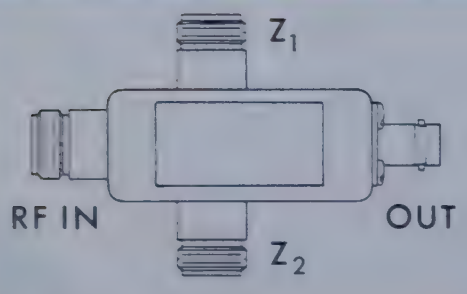
The RHO-TECTOR is a precision impedance comparator, incorporating a special frequency-insensitive RF bridge and detector circuit. Through its use, rapid and highly accurate determinations of VSWR values can be made over many decades of frequency.

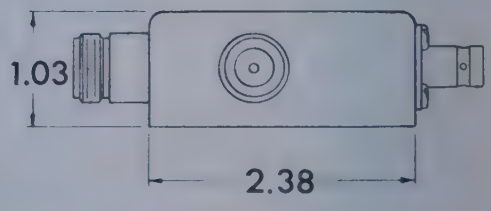
When used with an RF sweep generator and oscilloscope the RHO-TECTOR permits the direct display of VSWR vs. frequency. This method is ideally suited to laboratory and production testing of RF filters, terminations, and coaxial components of all types.

Though the RHO-TECTOR is optimized for operation at a 50 ohm impedance level, it may be used at any standard coaxial impedance.

TYPE	TRB-1	TRB-2	TRB-3
FREQUENCY RANGE	1 Mc TO 1 Gc	1 Mc TO 2.5 Gc	1 Mc to 1 Gc
UNBALANCE (RETURN LOSS)	30DB MIN.	30DB MIN.	50DB MIN. 1-800 Mc 45DB MIN. 800 Mc - 1 Gc
OUTPUT POLARITY	NEGATIVE	NEGATIVE	NEGATIVE
OUTPUT TIME CONSTANT	10 USEC	10 USEC	10 USEC
MAXIMUM POWER INPUT	1 WATT	.5 WATT	.5 WATT
CONNECTORS: RF INPUT Z_1, Z_2 OUTPUT	N JACK N JACK BNC JACK	N JACK N JACK BNC JACK	N JACK N JACK BNC JACK
WEIGHT	8 OZ.	8 OZ.	8 OZ.

OUTLINE DIMENSIONS



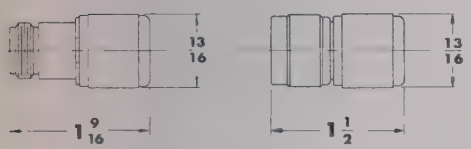


MICROWAVE TERMINATIONS Series TRM-1, TRM-2

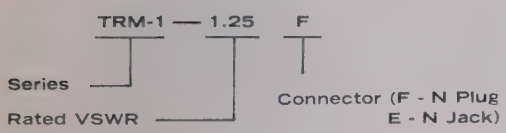
- *WIDE BANDWIDTH*
- *21 VSWR VALUES*
- *HIGH ACCURACY*
- *CERTIFIED PERFORMANCE*

The Telonic Series TRM Terminations are designed to meet the requirements for broadband, calibrated VSWR standards, and are especially useful for the calibration of VSWR comparison and gauging systems.
Protected, metal-film resistors in precision tapers are used in the TRM construction to assure carefully controlled reflection coefficients that are nearly independent of frequency. Each termination will effect its rated VSWR (±5%) in a 50 ohm system. TRM Terminations are not intended for use as matched loads at impedances other than 50 ohms.

OUTLINE DIMENSIONS



ORDERING INFORMATION



TYPE*	TRM-1	TRM-2
FREQUENCY RANGE	0 TO 3 Gc	0 TO 1 Gc
REFERENCE IMPEDANCE	50 OHMS	50 OHMS
VSWR ACCURACY	5%	10%
POWER RATING	2 WATTS	2 WATTS
WEIGHT (oz.)	2.5	2.5
MATERIAL	SILVER-PLATED BRASS	SILVER-PLATED BRASS
CONNECTORS	N JACK OR PLUG	N JACK OR PLUG
STANDARD VSWR VALUES	1.00, 1.10, 1.20, 1.25, 1.30, 1.40, 1.50, 1.60, 1.70, 1.75, 1.80, 1.90, 2.0	2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0

*TRM-S, (Short) and TRM-O, (Open), are also available in the same configuration.

VSWR MEASUREMENT KITS

- *RHO-TECTOR PLUS TERMINATIONS*
- *13 STANDARD VSWR VALUES*
- *2500 TO 1 BANDWIDTH*
- *FITTED CASE*

Telonic VSWR Kits consist of the TRB-1, TRB-2, or TRB-3 RHO-TECTOR, 2 standard matched terminations (VSWR 1:1) and 2 mismatches as specified by the purchaser. If no VSWR value is specified, mismatches with values of 1.5:1 and 2.0:1 will be supplied.

All 5 items are packaged in a fitted wooden instrument case with latching lid for maximum protection.

VSWR KIT NO. TRK-1		VSWR KIT NO. TRK-2		VSWR KIT NO. TRK-3	
QUAN.	ITEM	QUAN.	ITEM	QUAN.	ITEM
1	TRB-1 RHO-TECTOR	1	TRB-2 RHO-TECTOR	1	TRB-3 RHO-TECTOR
2	TRM-1-1.00F Terminations	2	TRM-1-1.00F Terminations	2	TRM-1-1.00F Terminations
2	TRM-1 Mismatches	2	TRM-1 Mismatches	2	TRM-1 Mismatches
1	Fitted Case	1	Fitted Case	1	Fitted Case

Special units optimized for specific frequency ranges and with higher return loss (unbalance) are available on special order.

Analysis and Application of the RHO-TECTOR

The RHO-TECTOR is a symmetrical bridge, two legs of which consist of externally connected impedances, Z_1 and Z_2. Incorporated within the RHO-TECTOR is a floating detector. When Z_1 and Z_2 are identical, the detector output is zero (assuming a perfectly symmetrical bridge). For the simplest case, in which Z_2 is a 50-ohm "standard" impedance, (such as a Telonic TRM1-1.00F), and ρ is the reflection coefficient of Z_1 (the "unknown"), referred to Z_2, then

$$E_o = KE_s^2 |\rho|^2 , \qquad (1)$$

where E_o is the detector output voltage, E_s is the RF input voltage, and K is a detector constant. If S is the VSWR of Z_1 referred to Z_2, then this can be written as

$$E_o = KE_s^2 \left|\frac{S-1}{S+1}\right|^2 , \qquad (2)$$

the form which is graphed below.

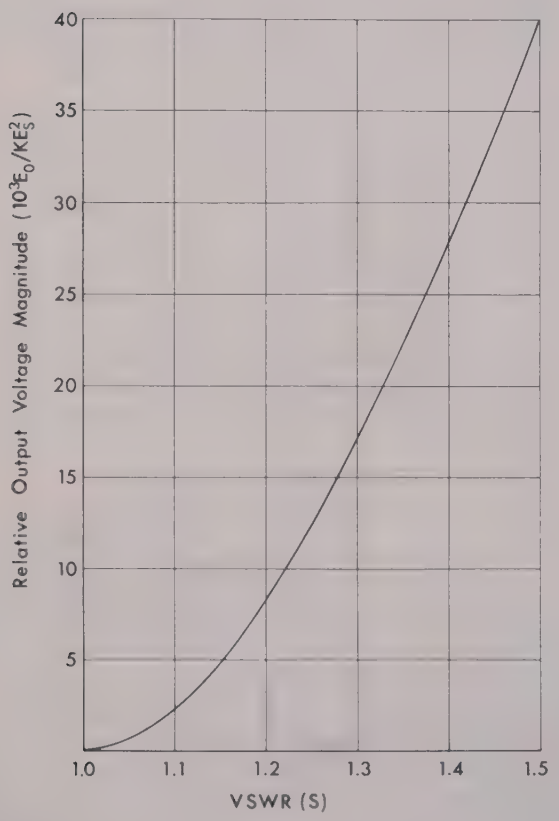


Figure 9

In a typical application, calibration is achieved by first comparing a termination of known VSWR (such as a Telonic TRM1-1.50F, which has a VSWR of 1.50/1) with the impedance standard. Correlation of other indications and VSWR levels is easily accomplished using the curve in Figure 12 or equation 2.

The effect of bridge asymmetry is to introduce an error similar to that caused by imperfect directivity in a reflectometer, or finite isolation in a hybrid. This unbalance or return loss error causes an output null to occur when the VSWR of Z_2, referred to Z_1, is (1+e)/1, rather than 1/1. The error, e, is given closely by

$$e = 2 \cdot 10^{-B/20} , \qquad (3)$$

where B is the unbalance in db.

B(db)	e(%)
30	6.33
35	3.56
40	2.00
45	1.125
50	0.633
60	0.200

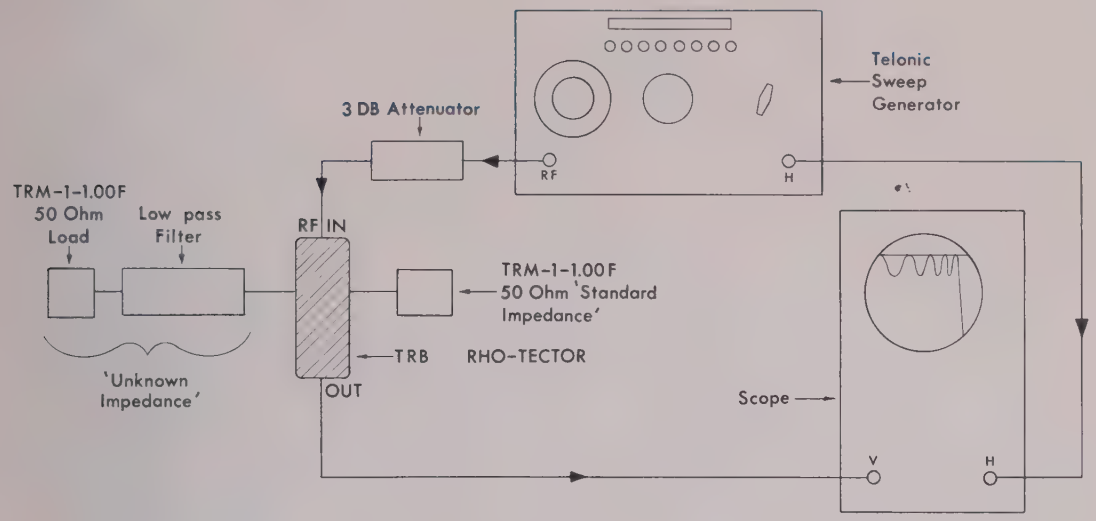


Figure 10

Notice that equations 1 and 2 involve the terms E_s^2, where E_s is the RF input voltage to the RHO-TECTOR. When both Z_1 and Z_2 are close to 50 ohms, the input impedance of the RHO-TECTOR is nearly 50 ohms, and little error is introduced by operation from a 50-ohm source with constant equivalent internal voltage. This is the typical operating mode shown in the test set up in Figures 10 and 11, and is entirely suitable for measurement of fairly low VSWR levels. The worst-case error which is introduced by operation from a 50-ohm source is less than $(10S^2-17S+7)\%$, which shows a 4% worst-case error at a VSWR level of 1.5/1, and no error at a VSWR or 1.0/1. A typical oscilloscope presentation of VSWR is shown in figure 13.

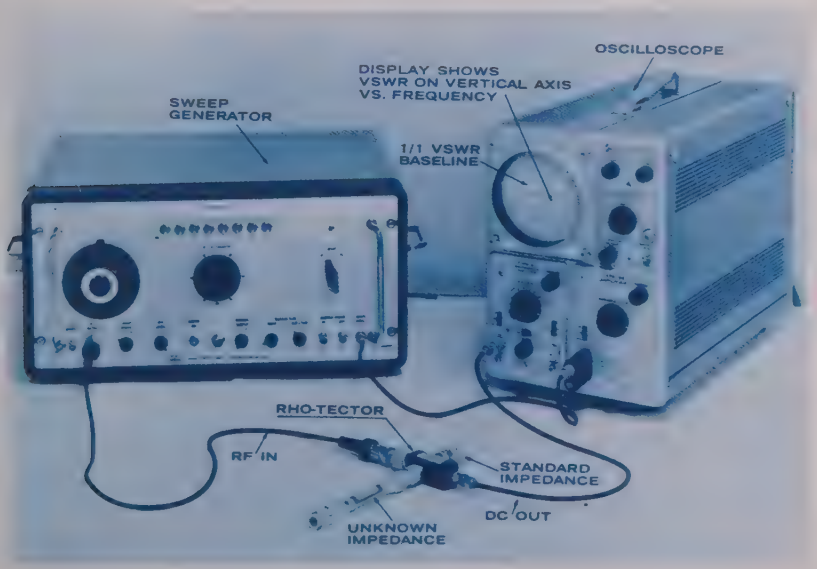


Figure 11

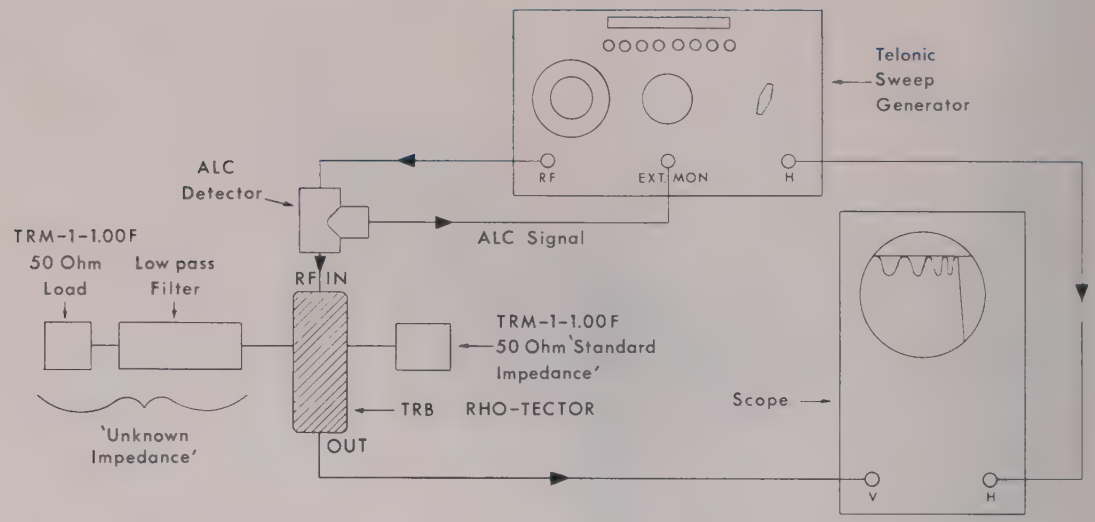


Figure 12

If accurate measurement of high VSWR levels (above 2.0/1) is desired, then it is necessary to control the RF input voltage to the RHO-TECTOR. A test set up, suitable for high VSWR levels, is shown in Figure 12.

Operation with "standard" impedance values of other than 50 ohms allows the broadband matching of complex and frequency-dependent impedances, as well as other fixed coaxial levels. The errors introduced by such operation vanish for the matched condition and are small with low VSWR levels. (For example, for a 75-ohm level, and a VSWR of 1.5:1, the worst-case error is less than 3.6%.)

The equation of operation, for the general case, is

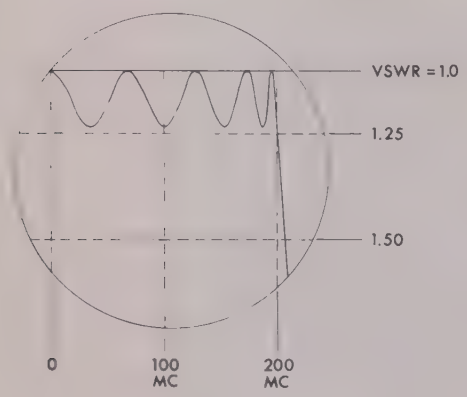


Figure 13

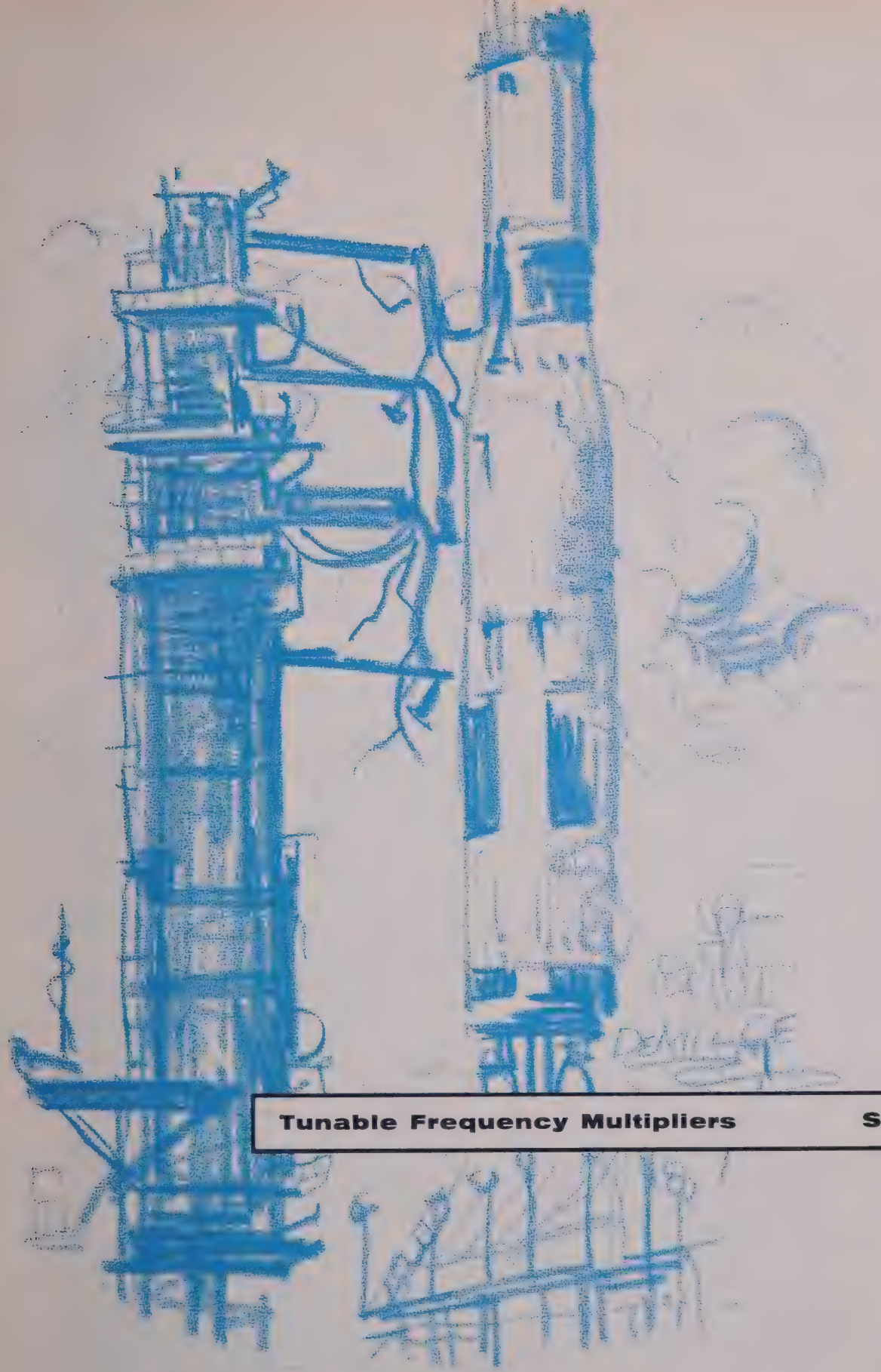
$$E_o = \frac{4KE_G^2 \{[(1+e)X_1 - Z_2]^2 + [(1+e)Y_1]^2\}}{[(1+e+Z_2)(1+X_1)+R(2+e+X_1+Z_2)]^2 + [(1+e+Z_2)+R]^2 Y_1^2} \quad (4)$$

where: $Z_1 = X_1 + jY_1$.

R = Generator internal impedance.

E_G = Generator internal voltage.

(All impedances are normalized to 50 ohms.)



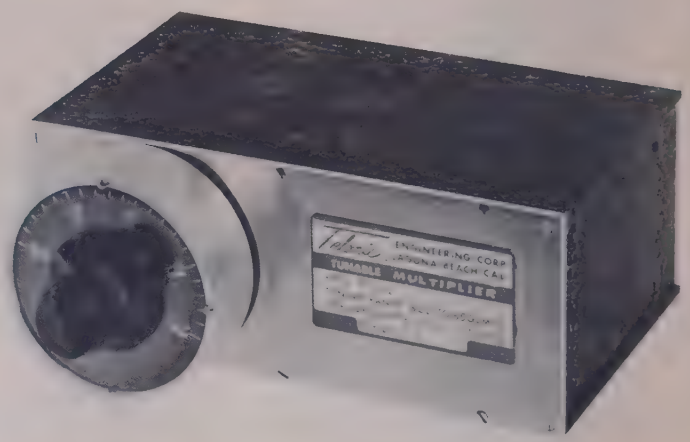
Tunable Frequency Multipliers

Section 6

TUNABLE FREQUENCY MULTIPLIERS

Series TTM-2, TTM-3

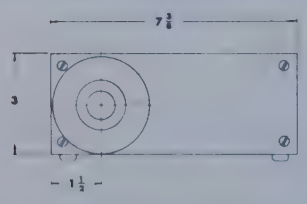
- *1 TO 2 Gc OUTPUT*
- *HIGH EFFICIENCY*
- *10% BANDWIDTH*
- *SELF BIASED*
- *1 WATT OUTPUT*
- *HIGH PURITY*



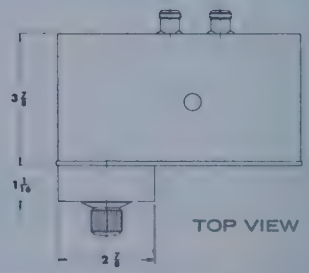
Telonic TTM Tunable Frequency Multipliers utilize two gang-tuned filters with a unique varactor circuit to achieve high-efficiency frequency doubling over a wide tuning range. Primarily designed for extending the frequency range of high powered sweep and signal generators, these multipliers are also well suited for any application necessitating frequency multiplication from the .5 to 1.0 Gc range.

TYPE	TTM-2	TTM-3
INPUT-FREQUENCY RANGE	0.50 TO 0.85 Gc	0.6 TO 1.0 Gc
OUTPUT-FREQUENCY RANGE	1.0 TO 1.7 Gc	1.2 TO 2.0 Gc
INPUT POWER	2 WATTS	
CONVERSION LOSS	3 DB	
BANDWIDTH	10% MINIMUM	
PASSBAND RIPPLE	±0.75 DB MAXIMUM	
SPURIOUS ATTENUATION	30 DB MINIMUM	
CONNECTORS	N JACK	
DIAL ACCURACY	±1%	

OUTLINE DIMENSIONS



FRONT VIEW



TOP VIEW

Special Products Section 7

FREQUENCY MULTIPLIERS Series TFM

TFM Frequency Multipliers are light weight, stable, rugged devices, exhibiting high efficiency and high-purity frequency multiplication in an unusually small package.

TYPICAL SPECIFICATIONS

INPUT FREQUENCY	960 Mc
OUTPUT FREQUENCY	1920 Mc
INPUT POWER	1 Watt
CONVERSION LOSS	4 db
SPURIOUS OUTPUT	30 db down, min

FREQUENCY MULTIPLEXERS Series TMX

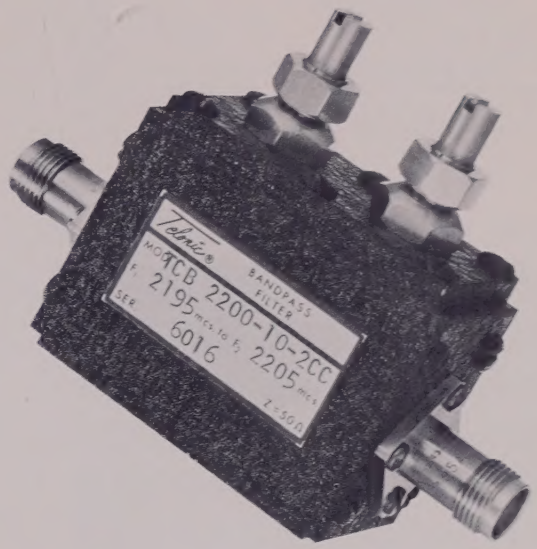
Telonic TMX Multiplexers are miniature devices available in a broad range of center frequencies, with or without impedance transformation. They provide excellent channel separation and may be specified in designs with 2 to 10 channels.

TYPICAL SPECIFICATIONS

CHANNEL FREQUENCIES	363 mc 384 mc 405 mc 427 mc
CHANNEL SEPARATION	40 db
INPUT IMPEDANCE	50 ohms
OUTPUT IMPEDANCE	25 ohms

ADJUSTABLE CAVITY FILTERS Series TCB

The Series TCB Adjustable Cavity Filters combine a very high Q, iris-coupled design with the convenience of manual adjustment. They provide a very stable, highly selective filter where resetting of the center frequency is necessary.



TYPICAL SPECIFICATIONS

ADJUSTMENT RANGE	2100 to 2200 mc
INSERTION LOSS	0.5 db, maximum
3 db BANDWIDTH	34 mc, minimum
0.2 db BANDWIDTH	17 mc, minimum
30 db BANDWIDTH	280 mc, maximum

POWER DIVIDERS Series TPD

Telonic TPD Power Dividers are designed to achieve precision power splitting with minimum insertion loss even at low frequencies. Miniature devices, they are ruggedly built for both electrical and mechanical dependability.

TYPICAL SPECIFICATIONS

FREQUENCY RANGE	640 to 780 mc
NOMINAL IMPEDANCE	50 ohms
INSERTION LOSS	0.5 db
VSWR	1.2:1
POWER LEVEL	10 Watts
BALANCE	0.2 db

IMPEDANCE TRANSFORMERS Series TZT

Telonic TZT Impedance Transformers have been developed to permit impedance matching between components or systems without the inherent power losses encountered with resistive pads.

TYPICAL SPECIFICATIONS

INPUT IMPEDANCE	50 ohms
OUTPUT IMPEDANCE	75 ohms
FREQUENCY RANGE	170 to 210 mc
INSERTION LOSS	0.5 db
VSWR	1.1:1
POWER LEVEL	5 Watts

Telonic
ENGINEERING CO.

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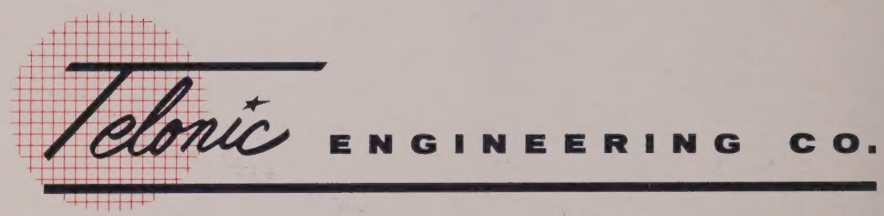
4515 Prentice St.
214-368-3566

TEXAS
HOUSTON
Texas Avionics
P. O. Box 60236
713-486-6710

VIRGINIA
RICHMOND
C. E. Snow Co.
5705 Grove Ave.
703-353-8008

WASHINGTON
SEATTLE
Seatronics, Inc.
6133 Maynard Ave., So.
206-323-1023
TWX 206-998-1255



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